Statement of
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International Relations Subcommittee
Committee on Government Reform
U. S. House of Representatives
Regarding
Research on Gulf War Veterans' Illnesses

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**

Mr. Chairman and members of the Subcommittee, thank you for this opportunity to discuss the status of the current federal research program on Gulf War veterans' illnesses. I serve as the Department of Veterans Affairs' (VA) Chief Research and Development Officer and the Chairperson of the Research Working Group (RWG) of the Persian Gulf Veterans Coordinating Board (PGVCB). Accompanying me today is Dr. Mark Brown who is the Director of VA's Environmental Agents Service.

In your invitation letter, you indicated that the purpose of the hearing was to review the findings and the recommendations of the recent Institute of Medicine (IOM) report, *Gulf War and Health, Volume 1*.: *Depleted Uranium, Sarin, Pyridostigmine Bromide, Vaccines*. You also requested a discussion of the plans for additional research by the IOM, and a status report on other research on Gulf War veterans' illnesses, both underway and completed.

As you know, the United States deployed nearly 700,000 military personnel during the Gulf War from August 1990 to the cease-fire on February 28, 1991. Within months of their return, some Gulf War veterans reported various symptoms and illnesses that they considered to be connected to their war-time service. Veterans, their families, and the VA have been concerned about possible health effects from exposures during the Gulf War, including the anti-nerve-agent drug pyridostigmine bromide, depleted uranium, vaccines, and chemical warfare agents.

Overview of the Research Portfolio on Gulf War Veterans' Illnesses

To date, the Federal government is projecting cumulative expenditures of $151 million for Gulf War research from FY 1994 through FY 2000. There are over 192 projects at various stages

of completion in the research portfolio on these veterans' illnesses. In FY 1999 and FY 2000, 42 new projects have been added to this portfolio. Research projects have been funded in the categories of basic research and applied research, such as clinical epidemiology and population-based epidemiologic research. To date, 83 federally funded projects have been completed. All projects and their focus areas are described in detail in annual reports that are submitted to Congress each year.

IOM Report: *Gulf War and Health, Volume 1.*

Background on the IOM Report

The Under Secretary for Health sent a letter to the National Academy of Sciences Institute of Medicine (IOM) on October 31, 1997 requesting an IOM study. The purpose of the study was to comprehensively review, evaluate, and summarize the published peer reviewed scientific literature regarding the associations between various Gulf War exposures and adverse health effects experienced by some Gulf War veterans. The IOM was also requested to make recommendations for additional scientific studies to resolve areas of continued scientific uncertainty related to health consequences of Gulf War service. On June 24, 1998, VA signed a contract with the IOM for a 27-month study, at a total cost of $1.25 million.

This effort was modeled after the successful process VA has used since the early 1990s to establish compensation policy for Vietnam veterans exposed to Agent Orange.

Four months later, in October 1998, Congress supported this effort with legislative mandates, including the "Veterans Programs Enhancement Act of 1998" (Pub.L. No. 105-368) and the "Persian Gulf War Veterans Act of 1998" (Pub. L. No. 105-277). The contract with IOM meets the requirements of these Acts.

The IOM reviewed the scientific and medical literature on the adverse health effects associated with exposure to sarin, pyridostigmine bromide, vaccines, and depleted uranium. The review took into account the strength of scientific evidence and the appropriateness of the scientific methods used to identify associations. It includes an assessment of biologic plausibility that these exposures are associated with illnesses experienced by Gulf War veterans. In many cases, the data distinguished differences between transient and long-term health effects, related to the dose of the exposure. Therefore, IOM reported separate findings on the potential transient, short-term effects of each exposure, as well as the potential long-term effects. As required by P. L. 105-277 and P. L. 105-368, the Department is currently evaluating the IOM report to determine whether or not a presumption of service connection is warranted for any illness related to the exposures covered in the report.

A major strength of the study is that in planning its work, the IOM committee asked representatives of veterans service organizations for advice in setting its priorities. Veterans

advised the committee to begin the project by reviewing these specific risk factors. Therefore, this report looked at the exposures that were of greatest health concern to veterans themselves. The IOM report should provide some reassurance to veterans and their families about these health concerns.

Findings and Recommendations of the IOM Report and
Response of the Research Working Group

Sarin:

- IOM Findings on potential long-term effects of sarin: IOM concluded that there was limited or suggestive evidence of an association between "exposure to sarin at doses sufficient to cause acute cholinergic signs and symptoms and subsequent long-term health effects." IOM concluded that there was inadequate evidence to determine whether an association does or does not exist between "sarin at low doses insufficient to cause acute cholinergic signs and symptoms and subsequent adverse long-term effects."

- Basis for IOM Findings on potential long-term health effects of sarin: IOM stated that, after human exposures to sarin at doses high enough to cause poisoning symptoms, numerous chronic effects have been reported. These health effects have been observed in industrial workers accidentally exposed to sarin in the U.S. and in the two terrorism attacks in Japan. IOM noted that "there are no well-controlled studies of long-term health effects in humans exposed to sarin at doses that do not produce acute signs and symptoms."

- IOM Recommendations and Research Working Group Response:

1. Long-term follow-up of populations exposed to sarin in the Matsumoto and Tokyo terrorist attacks.
    - The RWG concurs with IOM's recommendation that Japanese scientists should continue the long-term follow-up of populations exposed to sarin in the Matsumoto and Tokyo terrorist attacks. We plan to keep apprised of the results of these studies.

2. Studies in experimental animals to investigate the long-term effects of an acute, short-term exposure to sarin at doses that do not cause overt cholinergic effects and minimal acetylcholinesterase inhibition.
    - Since 1996, DoD has funded several studies of the long-term effects of short-term sarin exposure at doses that do not cause overt symptoms and cause only minimal acetylcholinesterase inhibition. Nine toxicology studies are focusing on the effects of sarin, alone or in combination. These combinations have included PB, DEET, permethrin, chlorpyrifos, heat stress and/or exercise stress.

3. In addition to the IOM recommendation on animal studies on sarin, the RWG is coordinating three epidemiological studies that are focusing on the health of veterans potentially exposed to low-level sarin due to the demolitions at Khamisiyah. The results of one of these projects were published in 1999 (project DoD-1B). The conclusion was there were no differences in rates of health problems among Gulf War veterans, who were potentially exposed to subclinical levels of sarin, compared to Gulf War veterans who were not exposed. The second Khamisiyah-related project is being performed by the Oregon Health Sciences University (DoD-63). The purpose is to compare neurological symptoms and results of neurobehavioral tests between Gulf War veterans, who were potentially exposed to low levels of sarin, versus Gulf War veterans who were not exposed. The third Khamisiyah-related project is being performed by the Medical Follow-Up Agency (MFUA) of the IOM (DoD-69). The purpose is to compare self-reported health problems between Gulf War veterans, who were potentially exposed to low levels of sarin, versus Gulf War veterans who were not exposed.

4. In addition to the IOM recommendation on animal studies on sarin, the RWG coordinated a contract for MFUA to perform an epidemiologic study of the long-term effects of short-term exposure to nerve agents in human volunteers in experiments conducted at Aberdeen Proving Ground in the 1950s to 1970s (DoD-93).

5. Research on genetic factors that may alter susceptibility to sarin toxicity.

- VA and DoD have funded a number of research projects on genetic factors that may alter the susceptibility to sarin and/or PB toxicity. These studies are described in detail in the section on PB below.

Pyridostigmine Bromide (PB):

- IOM Findings on potential long-term effects of PB: IOM concluded that there was inadequate evidence to determine whether an association does or does not exist between PB and long-term adverse health effects.

- Basis for IOM Findings on potential long-term health effects of PB: IOM noted that no reports of chronic toxicity were available related to human PB exposure in clinical or military populations. IOM reviewed two studies of PB use in Gulf War veterans, and concluded “the epidemiological data do not provide evidence of a link between PB and chronic illness in Gulf War veterans.”

- IOM Recommendations and Research Working Group Response:

1. Research on chemical interactions between PB and other agents such as stressful stimuli, and certain insecticides.

- Since 1994, VA and DoD have funded 30 projects related to PB, alone or in combination with other chemicals or stressful stimuli. In particular, VA and DoD have funded 18 projects on the potential interactions between PB and other agents. Five of these projects have published results, focusing on the effects of PB in rodents, in combination with DEET, permethrin, swimming stress, restraint stress, or exercise stress (projects VA-49, DoD-10, DoD-37, DoD-62, DoD-65). One important and consistent result of recent studies is that stressful stimuli, such as swimming stress or restraint stress, do not cause an increase in the permeability of the blood-brain barrier, or cause PB to cross the blood-brain barrier into the brain. In 1996, the earliest research in this area was performed, which indicated increased permeability of the blood brain barrier to PB, due to swimming stress in a particular strain of mice. Several more recent studies have failed to replicate this finding using a variety of species, types of stressful stimuli, and extremely high doses of PB.

2. Research on differences in genetic susceptibility (e.g., genetic polymorphisms of butyrylcholinesterase or paraoxonase) that may contribute to increased risk of disease.

- VA and DoD have funded eight projects on genetic factors that may alter susceptibility to the effects of PB or sarin, including polymorphisms of enzymes. Four projects in humans are evaluating the effects of genetic differences in polymorphisms of acetylcholinesterase, butyrylcholinesterase, and/or paraoxonase (projects DoD-21, DoD-60, DoD-65, DoD-112). Two projects in humans are evaluating the effects of gender and weight (project DoD-11, DoD-64). Two projects in rats are evaluating the effects of genetic differences in polymorphisms of acetylcholinesterase and butyrylcholinesterase (VA-5D, VA-49).

3. Epidemiological studies on the possible long-term health effects of PB.

- The RWG concurs with IOM that neurologists, who perform long-term follow-up of the course and treatment of myasthenia patients, should consider the possible long-term effects of PB. These patients take PB for many years. IOM concluded that PB has been used safely and effectively in thousands of myasthenia gravis patients since the 1950s. However, there has not been a systematic evaluation to determine if there are subtle long-term effects. We plan to keep apprised of the results of such long-term studies of myasthenia gravis patients, and have instituted contacts on this issue with the Myasthenia Gravis Foundation of America.

Vaccines:

- IOM Findings on the potential long-term effects of vaccines: IOM concluded that there was inadequate evidence to determine whether an association does or does not exist between anthrax vaccination, botulinum toxoid vaccination, or multiple vaccinations, and long-term adverse health effects.

- Basis for IOM Findings on potential long-term health effects of vaccines: IOM stated there were no published, controlled studies of the long-term effects of anthrax vaccination or botulinum toxoid vaccination. IOM reviewed only a few studies of the long-term effects of multiple vaccinations, which were too limited to draw conclusions.

- IOM Recommendations and Research Working Group Response:

1. Long-term systematic research to examine potential adverse effects of anthrax and botulinum toxoid vaccination in multiple species and strains of animals.
    - The RWG concurs that long-term research is needed to examine potential adverse effects of anthrax and botulinum toxoid vaccination in experimental animals. Such research is underway in DoD laboratories. Also, CDC plans to fund non-human primate studies of the health effects and efficacy of the anthrax vaccine in late 2000.

2. Identification of cohorts of Gulf War veterans and Gulf War era veterans, for whom vaccination records exist, followed by careful studies of current symptoms, functional status, and disease status.
    - The Centers for Disease Control and Prevention (CDC) published a study of Air Force Gulf War veterans in 1998, which included measuring antibodies to anthrax and botulinum to determine which individuals had received the vaccines. The CDC found no relationship between the vaccinations and the development of a multisymptom illness (chronic symptoms of fatigue, cognitive and mood problems, and musculoskeletal pain).
    - The United Kingdom has also published a study in 2000 on a cohort of 923 Gulf War veterans for whom vaccination records exist. There was no association between having received the anthrax vaccine and the development of multisymptom illness, as defined by CDC.

3. Long-term longitudinal studies of the participants in the Anthrax Vaccine Immunization Program that would actively monitor and systematically collect and analyze data about symptoms, functional status, and disease status.
    - In 1999, DoD funded a long-term longitudinal study of participants in the Anthrax Vaccine Immunization Program. The Naval Health Research Center is establishing DoD-wide surveillance of hospitalizations in military hospitals, linking these to data on

anthrax vaccine recipients (project DoD-99). This active surveillance system ensures early detection of any associations between vaccinations and severe reactions that require hospitalizations. In addition, there are several ongoing projects that are following smaller groups of vaccine recipients to evaluate adverse effects. In Chapter 7, IOM summarizes several of these smaller completed and ongoing human studies, nearly all of which are unpublished. IOM strongly urges the DoD investigators who are conducting these studies to submit their results to peer-reviewed journals for publication. Additionally, IOM recently started a new two-year study on the safety and efficacy of the anthrax vaccine, funded by DoD. This new study will review some of the unpublished, non-peer reviewed information that was not previously available.

Depleted Uranium (DU):

- IOM Findings on the potential long-term health effects of DU: IOM concluded that there is limited or suggestive evidence that there is no association between exposure to uranium and "lung cancer at cumulative internal dose levels lower than 200 millisieverts or 25 centigrays." IOM also concluded that there is limited or suggestive evidence that there is no association between exposure to uranium and "clinically significant renal dysfunction." IOM concluded that there was inadequate evidence to determine whether an association does or does not exist for several other potential long-term health effects.

- Basis for IOM Findings on the potential long-term health effects of DU: IOM states that lung cancer has been the focus of many cohort studies of workers in the uranium processing industry. Many of these studies were large (thousands of subjects) and had a long period of follow-up (more than 20 years). Lung cancer mortality was not increased among workers in most of these cohorts, and IOM focused on the best quality studies in forming its conclusions about radiation exposure and lung cancer. IOM states that the weight of the human evidence indicates little or no clinically important kidney toxicity due to uranium exposure. IOM cited the strongest evidence as the absence of kidney damage in Gulf War veterans exposed to DU from embedded shrapnel. Kidney function was normal in these veterans, years after exposure, despite very high urinary uranium concentrations.

- IOM Recommendations and Research Working Group Response:

1. Continued follow-up of the Baltimore cohort of Gulf War veterans with DU exposure. Long-term studies of the health of other Gulf War veterans at high risk for DU exposure (e.g. cleanup or radiation control units).

    - The RWG concurs with the long-term follow-up of the veterans in the Baltimore cohort, who were injured during friendly fire incidents. This cohort was expanded in

1999, beyond the original 33 individuals. While the Baltimore researchers have seen no definitive evidence of adverse clinical outcomes associated with uranium exposure to date, the veterans who were involved in the friendly fire incidents will remain under continuing medical surveillance. In addition, since mid-1998, VA and DoD have offered a DU medical evaluation to hundreds of other veterans with potential DU exposure, such as those involved in cleanup operations or radiation control units. To date, the published data have shown that only veterans who have retained metallic fragments have demonstrated persistently elevated urinary uranium levels.

2. Continued follow-up of the cohorts of uranium processing workers.
    - The RWG concurs that the long-term follow-up should continue of cohorts of uranium processing workers. Many of these studies involve employees of manufacturing facilities managed by the Department of Energy or its contractors. Because of the recent increase in interest in the employees of these facilities, ongoing surveillance is likely to intensify in the future. We plan to keep apprised of the results of these studies.
3. Additional studies of the effects of depleted uranium in animals.
    - DoD has funded five toxicology projects that are investigating the health effects of DU in experimental animals (DoD-7A, DoD-7B, DoD-121, DoD-122, DoD-123). In particular, since 1994, the Armed Forces Radiobiology Research Institute (AFRRI) has been investigating the health effects of embedded DU pellets on rats. In Chapter 4, IOM cites the results of several published AFRRI studies. For example, there was no detectable kidney toxicity in rats embedded with DU pellets, even at very high concentrations of urinary uranium. Also, in early 2000, DoD released a Broad Agency Announcement to fund additional studies of health effects of heavy metals in experimental animals, including DU. Outcomes of particular interest include effects on the lung, liver, kidney, and nervous systems; and localized soft tissue responses of embedded fragments. Awards for these projects should occur by late 2000.

Plans for Additional Reviews by the IOM

The present study is only the first phase of a long-term IOM review. VA has already initiated a new contract for the next phase of IOM's review of Gulf War environmental risk factors. The contract calls for the same type of thorough review of peer reviewed literature on health effects from exposure to solvents and pesticides used during the Gulf War. As with the previous study, it will require two years to complete, starting September 1, 2000, at a total cost of $3.57 million. Following that, we anticipate looking at the several other Gulf War risk factors. In addition, the VA and the IOM are committed to issuing updated reports as new evidence appears. VA has not ruled out any exposures as a possible contributor to Gulf War veterans' illnesses.

In summary, a process is in place to review the scientific evidence that becomes available regarding any health consequences from service during the Gulf War and to grant compensation benefits using the same model as was used for Vietnam veterans regarding Agent Orange.

Status Report on Research on Gulf War Veterans' Illnesses

We know that combat casualties do not always result in obvious wounds, and that some veterans from all conflicts return with debilitating health problems. VA recognizes its responsibility for developing effective treatments and prevention strategies for such diseases. Studies clearly show that some Gulf War veterans report a variety of chronic and ill-defined symptoms including fatigue, neurocognitive, and musculoskeletal problems, at rates that are significantly greater than non-deployed veterans.

Four Major Research Initiatives on Illnesses in Gulf War Veterans

Highlights of the ongoing research efforts on Gulf War veterans' illnesses include two major treatment trials, Phase III of the VA National Survey, and a new epidemiological study of amyotrophic lateral sclerosis (ALS) in Gulf War veterans.

As a result of epidemiological findings to date, subgroups of ill Gulf War veterans have been identified for whom trials of potential treatment are appropriate. In the spring of 1998, the VA Cooperative Studies Program initiated planning for two treatment trials, subsequently known as the "ABT" (antibiotic treatment) and "EBT" (exercise-behavioral therapy) trials. Both trials underwent thorough scientific review and were approved for funding only after rigorous external review provided by the Cooperative Studies Evaluation Committee. Patient characteristics for entry into both trials are similar. All veterans who served in the Gulf between August 1990 and August 1991 are eligible for the studies. Patients are considered to have Gulf War Veterans' Illnesses (GWVI) if they have at least two of three symptoms (fatigue, musculoskeletal pain,

neurocognitive dysfunction) that began after August 1990 and that have lasted for more than six months up to the present.

The ABT trial has completed its enrollment of 491 Gulf War veterans at 28 sites throughout the U.S. The study initiated patient accession in May of 1999. The primary hypothesis of the study is that antibiotic treatment directed against mycoplasma species will improve functional status of patients with GWVI who are tested as mycoplasma positive at baseline. The total cost of this treatment trial is approximately $13 million. The trial will be completed in October 2001, when patient follow-up is finished. Preliminary demographic information indicates that 15% of the study participants are women, nearly 20% represent minority groups, 37% have attained an educational level of college or higher, and about 70% are employed. Nearly 85% of patients enrolled in the study exhibit all three symptoms of fatigue, pain, and neurocognitive difficulties.

The EBT trial has completed enrollment of nearly 1,100 Gulf War veterans at 20 sites throughout the U.S. The study initiated patient accessions in April of 1999. The primary hypotheses of the study is that both aerobic exercise and cognitive behavioral therapy (CBT) will significantly improve physical function in veterans with GWVI, and that the combination of CBT and exercise will be more beneficial than either treatment would be alone. The cost of this treatment trial is approximately $9.3 million. The trial will be completed on or about December 2001.

Mr. Chairman, I will now provide you with an update of the VA National Survey of Persian Gulf Veterans authorized by Public Law 103-446.

As you may recall, the National Survey is designed to determine the prevalence of symptoms and illnesses among a national random sampling of Gulf War veterans. The Survey is being conducted in three phases. Phase I was a population-based mail survey of the health of 30,000 randomly selected veterans from the Gulf War era (15,000 Gulf War veterans and 15,000 non-Gulf War veterans, males and females). The data collection phase is complete and analysis of the data continues. Phase II consisted of a telephone interview of 2,000 non-respondents from Phase I (1,000 from each group) to determine if there are any response differences between respondents and non-respondents. Phase II is complete. In Phase III, 2,000 of the veterans who responded to the postal survey will be invited, along with their family members, to participate in a comprehensive physical examination protocol. These examinations are being conducted at 15 VA medical centers and involve specialized examinations including neurological, rheumatological, psychological, and pulmonological evaluations. When the National Survey is complete we will have a much clearer picture of the prevalence of symptoms and illnesses among Gulf War veterans.

The VA's Office of Research and Development awarded funds for Phase III of the National Health Survey of Persian Gulf Veterans in November 1998. Currently, 15 sites are

participating in these physical examinations. Thus far, this study has examined approximately 1,600 veterans, plus 2,000 of their spouses and children. The study will cost approximately $12 million and will complete patient recruitment in May of 2001.

The medical evaluations in Phase III are designed to determine:

- Whether Gulf War veterans have an increased prevalence of the following conditions frequently reported in the literature, compared to a control group of non-deployed veterans: Chronic Fatigue Syndrome (CFS); Fibromyalgia (FM); neurologic abnormalities, including peripheral neuropathy and cognitive dysfunction; and post-traumatic stress disorder (PTSD).
- Whether the specific medical conditions of arthritis, dermatitis, hypertension, bronchitis, and asthma, which have been reported more frequently among Gulf War veterans compared to non-deployed veterans, are at higher prevalence among deployed Gulf War veterans upon objective clinical examination.
- Whether the prevalence of any of these conditions is greater among the spouses of Gulf War veterans than among spouses of non-deployed veterans.
- Whether the prevalence of medical conditions and major birth defects found on a pediatric physical examination in the children conceived after the war is greater for Gulf War veterans than for non-deployed veterans.

Recently, Gulf War veterans have voiced concerns about a possible association between amyotrophic lateral sclerosis (ALS) and service in the war. Although there is no clear indication of an excess rate of ALS among Gulf veterans, the available data could represent an underestimate of the actual rate. Furthermore, preliminary data suggested that the age distribution of cases of ALS in Gulf veterans appeared to be younger than the age distribution of cases of ALS in the general U.S. population. Accordingly, VA is leading a research effort to identify all cases of ALS, or other motor-neuron diseases, occurring among Gulf War veterans. VA is collaborating with DoD, CDC, and various university disease experts to determine the veterans' health status and to describe their exposures to potential causal and risk factors for ALS, based on clinical examinations at VA or non-VA centers of excellence in neurologic diseases. This initial case-finding effort is ongoing, and is planned to continue through February 2001. This study should provide the most definitive information about the rate of ALS among Gulf veterans, and the age distribution of the diagnosed patients.

Other Research Initiatives on Illnesses in Gulf War Veterans

The research program has yielded several important results. Some of the highlights of recent research findings include:

- Population-based epidemiological studies have shown that Gulf War veterans report more symptoms and exposures than non-deployed veterans of the same era.

- The population-based study of Gulf War veterans in Iowa has shown that nearly 90% of Gulf War veterans reported their health status as "good" to "excellent," while the remainder rated their health status as "fair" to "poor," using standard measures of health status. A minority of them (14%) experienced a significant decline in their health status. Declines were noted in physical functioning and social functioning, while mental health scales showed improvement.
- Several major studies suggest that Gulf War veterans do not suffer from a unique, previously-unrecognized syndrome. In particular, four studies have evaluated the health of thousands of Gulf War veterans who served in: a) the US Air Force; b) the US Navy; c) all three US services; and d) all three services from Great Britain. In each study, Gulf War veterans and comparison groups of non-deployed veterans reported the same patterns of symptoms. The results of these four studies are consistent with IOM's conclusion that "Thus far, there is insufficient evidence to classify veterans' symptoms as a new syndrome." IOM also concluded "All Gulf War veterans do not experience the same array of symptoms. . . Thus, the nature of the symptoms suffered by many Gulf War veterans does not point to an obvious diagnosis, etiology, or standard treatment."
- The RWG has determined that population based longitudinal studies to determine the long-term health of Gulf War veterans are a high priority. There are two population based longitudinal studies underway that are supported by DoD and the Centers for Disease Prevention and Control (CDC). They are Iowa (CDC and DoD), and the United Kingdom (U.S. DoD). Altogether, these two studies are following up a total of approximately 12,000 veterans. Each of these studies has used questionnaires, including physical symptoms, psychological symptoms, and exposures during the Gulf War. Both the Iowa and United Kingdom studies have included comprehensive medical histories and physical examinations. VA will request proposals to conduct a pilot of a longitudinal study based on its National Gulf War Survey.
- Neurobehavioral studies of Gulf War veterans and control populations suggest that some Gulf War veterans may have brain function abnormalities in such areas as memory, cognition, and motor control. The current RWG research portfolio includes seven studies using methods of sophisticated brain imaging such as conventional and functional magnetic resonance imaging (fMRI), and magnetic resonance spectroscopy.
- VA has developed a plan to establish two new Centers for the Study of War-Related Illnesses. These new Centers will assist VA in the development of appropriate preventive strategies to minimize illness and injury following future conflicts, including both combat and peace-keeping operations, and to develop new approaches for improving the care of active-duty and veteran patients with war-related illnesses. VA has released its Request for Proposal for these new Centers and plans to fund them within the next few months.

- In early 2000, DoD published Broad Agency Announcements to announce the availability of research funding on four topics. The selection and awarding of funds will be completed by the end of 2000. The topics are:
    1. Toxicity of heavy metals that are relevant to the military, including DU;
    2. Biomarkers to assess toxic chemical exposures and health effects;
    3. Consequences of deployment stress on health and performance; and
    4. Physiologically based methods to assess health consequences of deployment.

Conclusions

As the federal research program continues to provide more results, we will substantially increase our understanding of Gulf War veterans' illnesses, which, in turn, will enhance our ability to diagnose and treat them. In addition, this newly gained knowledge will enhance prevention and intervention in illnesses in participants of future deployments.

Mr. Chairman, thank you again for permitting me this opportunity to summarize our work to date so that, using science, we may better understand the health problems of Gulf War veterans. You have my assurance that we will continue this effort to resolve or ameliorate health problems in this population to the greatest extent possible.

Mr. Chairman, I will conclude my testimony here and am happy to answer any questions you or other Committee members may have.